

in animal feeding. Research examined the effects of dietary levels (0, 15, 30 and 45%) of yellow (C05041) and brown (CDC Maria) canary seed on the performance and health of broiler chickens. Eight (6 birds each) and 5 (4 birds each) replications per treatment were used from 0 to 21 and 22 to 35 d (d) of age, respectively. Statistical analyses for growth performance and cause of mortality (0 to 21 and 22 to 35 d) and organ weights (35 d) were completed using SAS version 9.2 using Proc Mixed as a  $4 \times 2$  factorial arrangement. Proc Reg of SAS version 9.2, linear and quadratic regression analyses, were used to define the effect of canary seed level. Growth rate and feed intake were affected in a quadratic manner by canary seed level from 0 to 21 d with highest growth achieved by 15 and 30% treatments, but these response criteria were not affected from 22 to 35 d. Feed to gain ratio decreased linearly with increasing canary seed for both 0–21 and 22–35 d time periods. Mortality was not affected by level of canary seed. Birds fed the C05041 cultivar died more (primarily from yolk sac infection) than did birds fed CDC Maria from 0 to 7 d of age, but there was no effect of cultivar from 7 to 35 d of age. Level of canary seed affected jejunum, kidney and bursa of Fabricius proportional weights in a quadratic manner with no differences between the 0 and 45% treatments; cultivar did not affect the weights of these organs. On a percentage of live weight bases, level and cultivar of canary seed did not affect carcass, gizzard, ileum, heart, liver and spleen weights. No interactions were found between dietary level and cultivar of canary seed. Treatment did not affect gross necropsy at trial end or histopathology of key organs. Yellow and brown hairless canary seed has nutritional merit and is safe for animal feeding.

**Key Words:** canary seed, feed, growth, health, chicken

**47 The effects of varying levels of dietary raffinose and stachyose on the virulence of *Clostridium perfringens* in broiler chickens.** E. McMillan, D. Toole, G. Page, and M. Yegani\*, *Nutreco Canada, Guelph, ON, Canada.*

Diet composition is known to influence the occurrence and severity of necrotic enteritis (NE) caused by *Clostridium perfringens* (CP). Raffinose (RF) and stachyose (ST), anti-nutritional factors present in large quantities in soybean meal, are poorly digested in chickens, but have been cited as preferential energy sources for CP. Reducing the level of these carbohydrates in the diet may be associated with the lower occurrence of NE in broilers. The objective of this study was to investigate if the presence of varying levels of these compounds, derived from different soybean meal varieties, can have any impact on NE in broiler chickens in a NE disease challenge model. Ross 708 male broiler chicks (1,152) were assigned to 64 pens (18 birds per pen) in a completely randomized block design with a factorial arrangement of 2 diets (low or high levels of RF and ST) and 7 strains of CP in a 24-d study. In the pre-challenge period (d 0–14), feeding a low RF and ST diet significantly reduced feed intake ( $P = 0.006$ ) and improved FCR ( $P < 0.001$ ), with no impact on average daily gain ( $P = 0.35$ ). However, low RF and ST levels had no effects on performance variables post-challenge (d 14–24,  $P > 0.20$ ) or overall (d 0–24,  $P > 0.12$ ). Dietary levels of RF and ST had no effects on NE lesion scores ( $P = 0.17$ ) or mortality (NE-related or total mortality,  $P > 0.73$ ). The present results indicate that using low RF and ST soybean meal is of limited benefit in reducing NE severity in a challenge model, but may improve production performance of broiler chickens under non-challenge conditions.

**Key Words:** necrotic enteritis, *Clostridium perfringens*, raffinose and stachyose, lesion score, broiler chicken

**48 Influence of source and level of glycerin in the diet on growth performance, liver characteristics, and nutrient digestibility in broilers from 1 to 21 days of age.** H. A. Mandalawi<sup>1</sup>, M. V. Kimiaeit-alab<sup>1</sup>, V. Obregón<sup>2</sup>, D. Menoyo<sup>1</sup>, and G. G. Mateos<sup>\*1</sup>, <sup>1</sup>*Universidad Politécnica de Madrid, Madrid, Spain*, <sup>2</sup>*Bio-Oils Huelva, S.L., Huelva, Spain.*

In total, 630 one-day-old Ross-308 chicks were used to study the influence of source and level of inclusion of raw glycerin (Gly) in the diet on growth performance, digestive traits, total tract apparent retention (TTAR), and apparent ileal digestibility (AID) of nutrients in broilers from 1 to 21 d of age. There was a control diet based on corn and soybean meal and 8 additional diets that formed a  $2 \times 4$  factorial with 2 sources of Gly varying in glycerol content (H-Gly, 87.5% glycerol and L-Gly, 81.6% glycerol) and 4 levels of Gly inclusion (2.5, 5.0, 7.5, and 10%). The 2 Gly used were obtained from a single batch of soy oil used for biodiesel production, dried under 2 different processing conditions. Each treatment was replicated 7 times. Main effects and interaction were studied. Also, pre-planned polynomial contrasts were performed to study the L and Q effects of Gly level on the different traits. From d 1 to 21, FCR improved linearly (L,  $P < 0.01$ ) as the Gly content of the diet increased. At 21 d of age, the relative weight (% BW) of the digestive tract and liver (L,  $P < 0.01$ ) and the lipid content of the liver increased as the level of Gly in the diet increased. Liver color was not affected by diet. TTAR of DM was higher for the H-Gly diet than for the L-Gly diet ( $P < 0.05$ ) and increased quadratically (Q,  $P < 0.05$ ) as the Gly content of the diet increased. The AMEn of the diets increased (L,  $P < 0.001$ ) with Gly inclusion. Also, the AID of DM and GE increased ( $P < 0.01$ ) with increased level of dietary Gly. It is concluded that raw glycerin obtained from the biodiesel industry from soy oil can be used efficiently as a source of energy at levels of at least 10% in diets for broilers from 1 to 21 d of age.

**Key Words:** broiler performance, glycerol, ileal digestibility, liver lipid, nutrient retention

**49 Nutritive value and protein quality of soybean meals according to origin and crop year.** P. G. Rebollar, C. de Blas, R. Lázaro, B. Saldaña, and G. G. Mateos\*, *Universidad Politécnica Madrid, Madrid, Spain.*

Nutrient composition and protein quality of soybean meal (SBM) depend on genotype, environmental conditions during plant growth, storage, and processing of the beans. Previously (5 yr period; 2007–2011), we had collected and analyzed for major dietary components, AA, and protein quality a total of 387 samples collected from USA, Brazil (BRA), and Argentina (ARG). During yr 2012, 90 extra samples (30 per each country) were collected and the analytical data were compared with those of the previous 5 yr. On DM bases (samples of the 6 yr period; 2007–2012), SBM from USA ( $n = 179$ ) and BRA ( $n = 144$ ) had more CP (53.7, 53.0, and 51.7%;  $P < 0.001$ ) than SBM from ARG ( $n = 156$ ). Also, USA meals had more sucrose, oligosaccharides, and P contents, but less crude fiber and NDF than BRA meals, with ARG meals being intermediate ( $P < 0.001$ ). Trypsin inhibitor activity (3.5, 2.9, and 2.8 mg N/g), PDI (19.7, 15.3, and 16.4%), and KOH solubility (86.6, 82.6, and 81.6%) were higher ( $P < 0.001$ ) for USA than for BRA and ARG meals. Lys content per unit of CP was higher (6.16, 6.09, and 6.05%;  $P < 0.001$ ) for USA than for ARG and BRA meals. The average CP, P, and sugars contents of the SBM, independent of country of origin, were similar in the 2 periods considered. However, USA meals had less CP (52.5 vs. 53.9%;  $P < 0.05$ ) and more sucrose (8.9 vs. 8.1%;  $P < 0.05$ )

in 2012 than in the previous 5 yr period. Also, Lys profile independent of origin was higher for SBM of the 2012 crop than for the average of the 5 previous year crops (6.13 vs. 6.10% CP, respectively;  $P < 0.001$ ). The differences in nutrient content of the SBM among the 3 countries considered were similar in 2012 than in the previous 5 yr period. It is concluded that nutritive value of SBM varies with country of origin and

year of collection but that the differences among origins are maintained. Therefore, SBM had to be analyzed frequently, taking into account origin of the bean and crop year, to better evaluate its nutritional value.

**Key Words:** crop year, nutritive value, protein quality, soybean meal origin